Kiwifruit bacterial canker in 'Hayward' kiwifruit:

The application of observational study design and epidemiological techniques to the study of disease outbreaks affecting plant health

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Abstract

Bacterial canker of kiwifruit, caused by *Pseudomonas syringae* pv. *actinidiae* (Psa) biovar 3, was first recorded in New Zealand in November 2010 and quickly made production of the gold-fleshed kiwifruit cultivar, 'Hort16A', which is highly susceptible to Psa, no longer viable in the Bay of Plenty region. Production of the green-fleshed cultivar, 'Hayward' has remained viable but there is uncertainty around its long-term productivity. This thesis investigated aspects of Psa in commercial 'Hayward' orchards using observational studies. The aims were to: 1) quantify a change in productivity associated with disease; 2) determine the prevalence of disease in orchards; 3) identify factors that altered the initial development of disease and 4) identify factors that impact on the presence of severe disease. Severe disease was defined as 5% or more female vines in a block showing the systemic symptoms of green shoot wilt and cane dieback. To determine Psa effects on productivity historical data from 2599 'Hayward' orchards were analysed. No reduction in productivity was found until 1 year after initial detection of Psa, after controlling for other orchard inputs that affect productivity. A cross-sectional survey was sent to all Psa confirmed 'Hayward' orchards and 430 growers provided information about one of their 'Hayward' orchard blocks. The survey found 84% of orchard blocks were affected by disease and 57% had green shoot-wilt and/or cane dieback reported. Blocks typically had a low within block prevalence of systemic symptoms (Median = 5% of vines). In 194 orchards that were asymptomatic at the start of the study period the probability of disease developing in a block increased in association with use of Psa protectant sprays immediately post-pruning and using artificial pollination. A lower probability of disease developing was associated with undertaking summer girdling and with the presence of older male vines. The probability of developing severe disease was investigated in 331 orchard blocks that were symptomatic. The probability increased with time after Psa was first detected in a block and was highest when frost damage occurred, when poplar, cypress or pine shelter belts were present and when artificial pollination was used. The probability of severe bacterial canker was lower when spring girdling of female vines was undertaken. The results of this study can be used to prioritise future research. The thesis has also demonstrated the utility of observational studies for plant disease research.

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